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The geology of the Yellowstone Park is by Mr. W. H. Holmes, who describes the structure of the Yellowstone valley and its tributaries as well as the mountain ranges; of these the two most important, the Yellowstone and Washburn ranges, are composed of volcanic conglomerates, the larger part of the park being underlaid by rhyolite. The greater part of the volume, which relates to thermal springs and geysers, is treated in a broad and comprehensive way by Dr. C. A. Peale, and is an important contribution to this attractive subject. After describing the springs and geysers of the park, he discusses thermal springs and geysers in general, including those of Iceland, New Zealand, those of other parts of the United States, those of Mexico, Central America, the West Indies and South America, as well as those of Europe, the Azores, Africa, Indian ocean, Asia Minor and Asia, with those of Japan, Formosa, Malaysia, Australasia and Polynesia. Thermo-hydrology is then discussed under the heads of thermal springs, the chemistry of thermal waters (by C. A. Peale and Henry Leffmann), their formations and deposits, and the chemistry of deposits (also by Peale and Leffmann); this part closing with an account of geysers and theories of geysers, followed by a full bibliography of the subject. Dr. Peale describes and tabulates over two thousand springs and seventy-one geysers. The preliminary work on the geysers and geology of this world-renowned park has now been accomplished, but years of careful scientific work will be required to fill out the details. The report closes with a geographical account of the park, richly illustrated with maps by Mr. Henry Gannett, and the report of this distinguished geographer is a model of conciseness and critical accuracy. The entire report does great credit to the conduct of this famous survey and to the energy and foresightedness of the distinguished director.

BROOKS' LAW OF HEREDITY.[1]—This work is an elaborate attempt at a solution of the difficult problem of heredity, the author's theory being in a degree based upon Darwin's hypothesis of pangenesis.

The plan of the book is as follows: After giving first an outline of the chief hypotheses which have been published in explanation of heredity, with reasons for rejecting them, the author presents briefly, in outline, a statement of his own theory. He then attempts to show that this theory furnishes a basis for the theory of natural selection, that there is no *a priori* reason for rejecting this theory of heredity, and that it furnishes an explanation of many well-known facts which the author claims cannot without it be seen in their true relations. Finally the author at-

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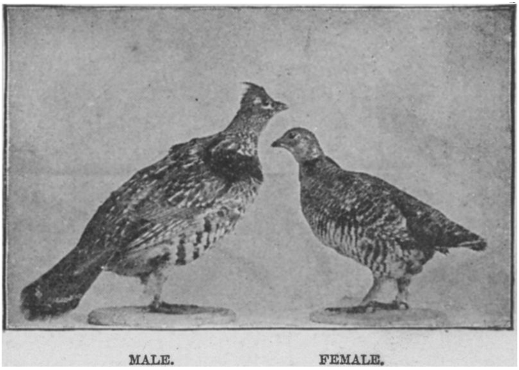
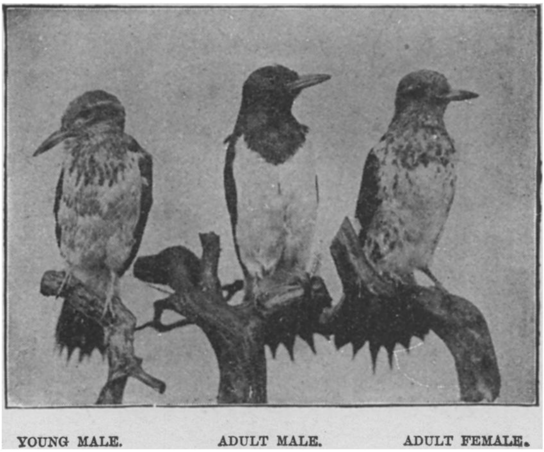
[1] *The Law of Heredity.* A study of the cause of Variation and the Origin of Living Organisms. By W. K. BROOKS, associate in Biology, Johns Hopkins University. Baltimore, John Murphy & Co. 1883. 12mo, pp. 336. With illustrations.

PLATE XXIV.



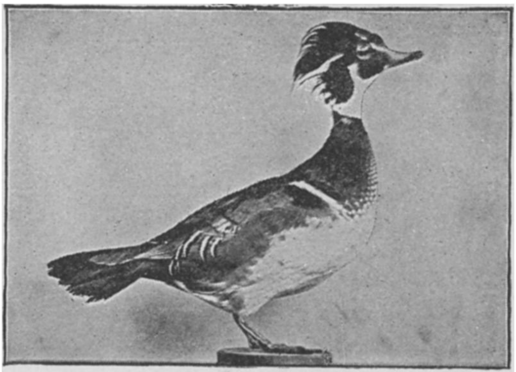
MALE AND FEMALE RUFFED GROUSE.



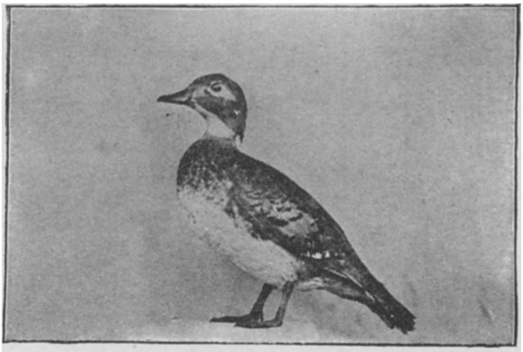
ADULT MALE, YOUNG MALE AND ADULT FEMALE OF THE RED HEADED WOODPECKER.

[*From photographs of stuffed specimens in the collection at Druid Hill Park, Baltimore.*]

PLATE XXV.



MALE.



FEMALE.

MALE AND FEMALE WOOD DUCK, TO SHOW SECONDARY SEXUAL CHARACTERS.

[From photographs of stuffed specimens in the Collection of the Maryland Academy of Sciences.]

tempts to show that it is supported by direct proof, and the work closes with an extended statement of the theory.

Professor Brooks' theory we will state in his own words: "The union of two sexual elements gives variability. Conjugation is the primitive form of sexual reproduction. Here the functions of the two elements are alike, and the union of parts derived from the bodies of two parents simply insures variability in the offspring. In all multicellular organisms the ovum and the male cell have gradually become specialized in different directions.

"The ovum is a cell which has gradually acquired a complicated organization, and which contains material particles of some kind to correspond to each of the hereditary characteristics of the species. The ovum, like other cells, is able to reproduce its like, and it not only gives rise, during its development, to the divergent cells of the organism, but also to cells like itself. The ovarian ova of the offspring are these latter cells, or their direct unmodified descendants.

"Each cell of the body is, in a morphological sense, an independent individual. It has the power to grow, to give rise, by division, to similar cells, and to throw off minute germs. During the evolution of the species it has, by natural selection, acquired distinctive properties or functions, which are adapted to the conditions under which it is placed. So long as these conditions remain unchanged, it performs its proper functions as a part of the body; but when, through a change in its environment, its function is disturbed and its conditions of life become unfavorable, it throws off small particles which are the germs or 'gemmules' of this particular cell.

"These germs may be carried to all parts of the body. They may penetrate to an ovarian ovum or to a bud, but the male cell has gradually acquired, as its special and distinctive function, a peculiar power to gather and store up germs.

"When the ovum is fertilized each germ or 'gemmule' unites with, conjugates with or impregnates that particle of the ovum which is destined to give rise in the offspring to the cell which corresponds to the one which produced the germ or gemmule; or else it unites with a closely related particle, destined to give rise to a closely related cell.

"When this cell becomes developed in the body of the offspring it will be a hybrid, and it will therefore tend to vary.

"As the ovarian ova of the offspring share by direct inheritance all the properties of the fertilized ovum, the organisms to which they ultimately give rise will tend to vary in the same way.

"A cell which has thus varied will continue to throw off gemmules, and thus to transmit variability to the corresponding part in the bodies of successive generations of descendants until a favorable variation is seized upon by natural selection.

"As the ovum which produced the organism thus selected will transmit the same variation to its ovarian ova by direct inheritance, the characteristic will be established as an hereditary race-characteristic, and will be perpetuated and transmitted, by the selected individuals and their descendants, without gemmules.

"According to this view, the origin of a new variation is neither purely fortuitous nor due to the direct and definite modifying influence of changed conditions. A change in the environment of a cell causes it to throw off gemmules, and thus to transmit to descendants a tendency to vary in the part which is affected by the change.

"The occurrence of a variation is due to the direct action of external conditions, but its precise character is not. My view of the cause of variation is thus seen to be midway between that accepted by Darwin and that advocated by Semper and other Lamarckians."

In a word then, Brooks' theory maintains that these gemmules only by chance pervade the whole body, but are, as a rule, confined to the male cell or spermatozoön, hence the male element is the originating and the female the perpetuating factor; the ovum is conservative; the male cell progressive. Heredity or adherence to type is brought about by the ovum; variation and adaptation through the male element, and the ovum is the essential, the male cell the secondary factor in heredity.

This theory is naturally open to the same general objection as that of pangenesis, which was, as Professor Brooks admits, effectually disproved by Galton's experiment, in which the transfusion of blood from certain varieties of rabbits into that of the silver-gray rabbit, produced no effect. These gemmules are metaphysical conceptions; they probably can never be detected. To test the theory properly we should think experiments might be made by inoculating with the supposed gemmules the testes of different mollusks or other low animals; but none have been reported by our author. As a speculation it is a very neat one, and the arguments and facts brought forward, most of them, however, from Darwin's works, will be read with interest. The theory is carefully thought out, well presented, and the work is a contribution of permanent value to a most difficult and elusive topic in philosophical biology.

We think still more might have been presented in the way of facts bearing upon the subject of the direct action of external conditions, and we think that this is of nearly equal importance, or rather affords the foundation for the action of heredity, as it is the source of most, if not all, variation, though we may be unable always to detect the operation of the law.

Speculation in good hands has always been a fruitful source of discovery, and the simple endeavor to discover the laws of heredity may at least lead to fresh fields of research.

After stating the theory, our author devotes a large part of the volume to a detailed statement of the evidence from hybrids, from variation, from secondary sexual characters; and this chapter is illustrated with the excellent figures here reproduced (Plates XXIV, XXV), which will speak for themselves.

In the tenth chapter the author considers the evidence from the intellectual differences between men and women; in the next chapter the author's theory is considered as supplementary to the theory of natural selection, the last chapter being in the way of recapitulation and conclusion.

Now and then the author shows a tendency to take for granted matters still in dispute, as, for instance, the nature of the process of conjugation, which is, if we understand it, not proved to be of the nature of sexual reproduction, though it would seem to be such. There are a number of slight but unneccessary typographical errors, and a word or two, such as Branchipus, is misspelt.

TRANSACTIONS OF THE KANSAS ACADEMY OF SCIENCE FOR 1881–2.—The eighth volume of this enterprising academy contains, among others, the following papers: The coal fields of Cherokee county, by E. Haworth; a preliminary list of fossils found in Riley county, by S. C. Mason; the igneous rocks of Kansas, by R. Hay; are there igneous rocks in Cherokee county? by E. Haworth; fossil wood, by R. Hay; protozoan remains in Kansas chalk, by G. E. Patrick; lists of Lepidoptera and Coleoptera collected in New Mexico by the Kansas University scientific expeditions of 1881 and 1882, by F. H. Snow; on the moths collected by Professor Snow in New Mexico, by A. R. Grote; observations of the nesting habits of the guillemots at Bird Rock, by N. S. Goss; notes on *Meleagris ocellata*, by G. F. Gaumer; notes on the habits of certain *Momotidæ*, by G. F. Gaumer; a contribution to the history of the fresh-water Copepoda, by F. W. Cragin (with four plates).

GALTON'S HUMAN FACULTY AND ITS DEVELOPMENT.[1] — This somewhat disjointed series of essays, though none the less interesting on that account, is the result of the author's wanderings into the highways and especially the byways of human psychology. Its perusal leaves one very distinct impression on the mind: the fact that there are striking differences between the minds of even closely related persons. As a shepherd knows individually each member of a large flock, so the attentive student of minds and human organizations recognizes a greater amount of individuality in men than the common observer realizes. That no two persons are alike bodily and mentally is of course universally acknowledged, and is almost axiomatic, but Mr. Galton makes us realize this fact as never before.

The book is a collection of scattered essays, published in dif-

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[1] *Inquiries into Human Faculty and its Development.* By FRANCIS GALTON F.R.S. New York, Macmillan & Co., 1883. 8vo, pp. 380, with illustrations.